Complete Summary

GUIDELINE TITLE

Practice parameter: neuroimaging of the neonate: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society.

BIBLIOGRAPHIC SOURCE(S)

Ment LR, Bada HS, Barnes P, Grant PE, Hirtz D, Papile LA, Pinto-Martin J, Rivkin M, Slovis TL. Practice parameter: neuroimaging of the neonate: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. Neurology 2002 Jun 25;58(12):1726-38. [117 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Conditions that may require neuroimaging of the neonate, such as:

- Very low birth weight (preterm)
- Neonatal encephalopathy

GUIDELINE CATEGORY

Diagnosis
Evaluation
Risk Assessment
Screening
Technology Assessment

CLINICAL SPECIALTY

Family Practice
Neurology
Pediatrics
Radiology

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To provide recommendations in response to the following questions regarding brain imaging of preterm (PT) infants:

- Which preterm infants should undergo routine screening ultrasonography (US)?
- When should these studies be performed?
- Do abnormalities on neonatal ultrasonography require follow-up magnetic resonance imaging (MRI)?
- What is the ability of ultrasonography to accurately predict long-term neurodevelopmental outcome in this patient population?

To provide recommendations in response to the following questions regarding brain imaging of term infants:

- Which imaging strategies are able to provide clinically important information in term infants with neonatal encephalopathy?
- Can magnetic resonance imaging provide prognostic information in these infants?

TARGET POPULATION

- Very low birth weight (VLBW) preterm neonates
- Encephalopathic term neonates

INTERVENTIONS AND PRACTICES CONSIDERED

1. Cranial ultrasonography (US), including gray-scale ultrasonography and Doppler ultrasonography
2. Computed tomography (CT)
3. Magnetic resonance imaging (MRI), including diffusion weighted magnetic resonance imaging (DWI) and proton magnetic resonance spectroscopy (MRS)

MAJOR OUTCOMES CONSIDERED

Primary neuroimaging measures:

- Intraventricular hemorrhage
- Preterm white matter injury
- Ventriculomegaly

Primary and secondary outcome measures:

- Specificity and sensitivity of neuroimaging for adverse neurodevelopmental outcomes
- Cerebral palsy
- Seizures
- Developmental delay at age 1 year
- Mental retardation
- Developmental quotient

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Evidence reviewed for this parameter was identified through literature searches using MEDLINE and EMBASE for the years 1990 to 2000 and CURRENT CONTENTS for 2000. This literature search was updated in June 2001. Relevant articles were included from English language literature using the following search terms: neonate, infant, brain, cerebral, MRI, MRS, diffusion weighted imaging (DWI), diffusion tensor imaging, US, echoencephalography, Doppler ultrasonography, cranial axial tomography, near-infrared spectroscopy, SPECT, germinal matrix hemorrhage, intraventricular hemorrhage (IVA), periventricular leukomalacia (PVL), stroke, ischemia, ventriculomegaly, and echodensity. Because neonatal practices and imaging strategies have changed over the past decade, the guideline developers reviewed only those references from 1990 onward.

NUMBER OF SOURCE DOCUMENTS

>1320 citations

90 met the predefined inclusion criteria

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Definitions for classification of diagnostic evidence

Class I: Evidence provided by a prospective study in a broad spectrum of persons with the suspected condition, using a "gold standard" for case definition, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy.

Class II: Evidence provided by a prospective study of a narrow spectrum of persons with the suspected condition, or a well designed retrospective study of a broad spectrum of persons with an established condition (by "gold standard") compared to a broad spectrum of controls, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy.

Class III: Evidence provided by a retrospective study where either persons with the established condition or controls are of a narrow spectrum, and where test is applied in a blinded evaluation.

Class IV: Any design where test is not applied in blinded evaluation OR evidence provided by expert opinion alone or in descriptive case series (without controls).

Definitions for classification of prognostic evidence

Class I: Evidence provided by a prospective study of a broad spectrum of persons who may be at risk for developing the outcome (e.g., target disease, work status). The study measures the predictive ability using an independent gold standard for case definition. The predictor is measured in an evaluation that is masked to clinical presentation, and the outcome is measured in an evaluation that is masked to the presence of the predictor.

Class II: Evidence provided by a prospective study of a narrow spectrum of persons who may be at risk for developing the outcome or by a retrospective study of a broad spectrum of persons with the outcome compared to a broad spectrum of controls. The study measures the predictive ability using an acceptable independent gold standard for case definition. The risk factor is measured in an evaluation that is masked to the outcome.

Class III: Evidence provided by a retrospective study where either the persons with the condition or the controls are of a narrow spectrum. The study measures the predictive ability using an acceptable independent gold standard for case definition. The risk factor is measured in an evaluation that is masked to the outcome.

Class IV: Any design where the predictor is not applied in a masked evaluation OR evidence provided by expert opinion or case series without controls.

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Each of the selected articles was reviewed, abstracted, and classified by at least two reviewers. Abstracted data included patient number, mean birth weights (BW), mean gestational ages, ages at the time(s) of the neuroimaging study(ies), primary neuroimaging measure, primary and secondary outcome measures, and timing of subject selection (prospective, retrospective, case-control, or case series). Guideline developers also noted both inclusion and exclusion criteria for

patient selection and a description of the neuroimaging strategy in addition to the results of the given study.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Definitions for strength of recommendations

Level A: Established as useful/predictive or not useful/ predictive for the given condition in the specified population (requires at least one convincing class I study or at least two consistent, convincing class II studies).

Level B: Probably useful/predictive or not useful/predictive for the given condition in the specified population (requires at least one convincing class II study or at least three consistent class III studies).

Level C: Possibly useful/predictive or not useful/predictive for the given condition in the specified population (requires at least two convincing and consistent class III studies).

Level U: Data inadequate or conflicting. Given current knowledge, test/predictor is unproven.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Draft guidelines were reviewed for accuracy, quality, and thoroughness by the American Academy of Neurology (AAN) members, topic experts, and pertinent physician organizations.

Final guidelines were approved by the American Academy of Neurology Quality Standards Subcommittee on December 8, 2001, the American Academy of Neurology Practice Committee on January 28, the American Academy of Neurology Board of Directors on February 23, the Child Neurology Society (CNS) Practice Committee on January 20, 2002. They were published in Neurology 2002;58:1726-1738.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Definitions of the classification of diagnostic evidence (Class I-IV), classification of prognostic evidence (Class I-IV), and strength of recommendations (A, B, C, U) are provided at the end of the "Major Recommendations" field.

Very Low Birth Weight (VLBW) Preterm (PT) Infants

Which pre-term infants should undergo routine screening cranial ultrasonography (US)?

Recommendations (Level B): Close to 25% of infants with gestational age (GA) of <30 weeks have significant cranial US abnormalities which trigger important changes in acute and long-term care. Therefore, routine screening cranial US should be performed on all infants with GA of <30 weeks.

When should screening cranial US studies be performed?

Recommendation (Level B): Screening cranial US should be performed on all infants with GA of <30 weeks at 7 to 14 days of age and should be optimally repeated at 36 to 40 weeks´ postmenstrual age. This recommendation is designed to detect both clinically unsuspected intraventricular hemorrhage (IVH), which may require additional clinical and/or radiologic monitoring and changes in management plans, and evidence for periventricular leukomalacia (PVL) and/or ventriculomegaly, which are useful for prognosis and best seen when the infants are examined at term.

Do abnormalities on neonatal screening cranial US require follow-up magnetic resonance imaging (MRI) either to obtain information for patient management or to provide long-term prognostic data?

Recommendation (Level C): Currently, data available from class II studies do not provide sufficient evidence that routine MRI should be performed on all very low birth weight (VLBW) infants for whom results of screening cranial US are abnormal.

What is the ability of neonatal cranial US to predict long-term neurodevelopmental outcome in VLBW PT infants?

Recommendation (Level A): For VLBW PT infants, US should be used to predict long-term neurodevelopmental outcome. The findings of grades 3 and 4 intraventricular hemorrhage, periventricular cystic lesions, and moderate to severe ventriculomegaly are all associated with adverse outcome.

Term Infants with Neonatal Encephalopathy

Which neonatal neuroimaging strategies can detect cerebral abnormalities that will affect the immediate and long-term management of the infant with neonatal encephalopathy?

Recommendations for Diagnostic Assessment

1. For infants with a history of neonatal encephalopathy, significant birth trauma, and evidence for low hematocrit or coagulopathy:
    a. Noncontrast computed tomography (CT) should be performed to look for hemorrhage (Level B)
    b. If the CT findings cannot explain the clinical status of the neonate, MRI should be performed (Level A).
2. For other neonates with acute encephalopathy:
    a. MRI should be performed between days 2 and days 8 of life (Level A).
    b. If single-voxel proton magnetic resonance spectroscopy (MRS) is available, MRI should include MRS (Level B).
    c. At the time of the MRI, diffusion-weighted MRI (DWI) should also be performed if this modality is available (Level C).
    d. CT should be performed only if MRI is not available, or if the neonate is too unstable for MRI (Level A).

Can MRI studies provide prognostic data for term infants with neonatal encephalopathy?

Recommendation. MRI should be performed within the first 2 to 8 days of life to provide predictive data for neurodevelopmental outcome in encephalopathic term infants (Level A). DWI (Level C) and MRS (Level B), when available, should also be performed within the first 2 to 8 days of life to provide prognostic data concerning neurodevelopmental outcome in these patients.

Definitions:

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Definitions for classification of prognostic evidence

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Level U: Data inadequate or conflicting. Given current knowledge, test/predictor is unproven.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Overall benefits

- These guidelines may assist physicians in making appropriate clinical decisions regarding the use of neuroimaging in preterm and term infants.
- Neuroimaging plays two important roles: (1) diagnosis of brain injury in the newborn at risk so that appropriate medical management can be provided, and (2) detection of those lesions associated with long-term neurodevelopmental disability.

Specific benefits

- Routine screening cranial ultrasonography (US) on preterm infants detects lesions such as intraventricular hemorrhage, which influences clinical care, and those such as periventricular leukomalacia and low-pressure ventriculomegaly, which provide information about long-term neurodevelopmental outcome.
- The pattern of injury identified with conventional magnetic resonance imaging (MRI) may provide diagnostic and prognostic information for term infants with evidence of encephalopathy.
- Diffusion-weighted imaging may allow earlier detection than conventional magnetic resonance imaging of cerebral injuries.

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

This statement is provided as an educational service of the American Academy of Neurology (AAN) and the Child Neurology Society (CNS). It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The American Academy of Neurology and the Child Neurology Society recognize that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness
Staying Healthy

IOM DOMAIN

Effectiveness
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

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ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2002 Jun 25

GUIDELINE DEVELOPER(S)

American Academy of Neurology - Medical Specialty Society
Child Neurology Society - Medical Specialty Society

SOURCE(S) OF FUNDING

American Academy of Neurology (AAN)

GUIDELINE COMMITTEE

Quality Standards Subcommittee of the American Academy of Neurology
Practice Committee of the Child Neurology Society

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

American Academy of Neurology (AAN) Quality Standards Subcommittee Members: Gary Franklin, MD, MPH (Co-Chair); Catherine Zahn, MD (Co-Chair); Milton Alter, MD, PhD; Stephen Ashwal, MD (facilitator); Richard M. Dubinsky, MD; Jacqueline French, MD; Michael Glantz, MD; Gary Gronseth, MD; Deborah Hirtz, MD; Robert G. Miller, MD; and William Weiner, MD

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: A list of American Academy of Neurology (AAN) guidelines, along with a link to a Portable Document Format (PDF) file for this guideline, is available at the AAN Web site.

Print copies: Available from the AAN Member Services Center, (800) 879-1960, or from AAN, 1080 Montreal Avenue, St. Paul, MN 55116.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- AAN guideline development process [online]. St. Paul (MN): American Academy of Neurology.

Electronic copies: Available from the American Academy of Neurology Web site.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on February 5, 2004.

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